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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/776,475

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Lawrence C. Gunn III

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EXAMINER

PETKOVSEK, DANIEL J

ART UNIT

PAPER NUMBER

2874

DATE MAILED: 11/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/776,475

Applicant(s)

GUNN ET AL.

Examiner

Daniel J. Petkovsek

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on IDS filed March 3, 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-49, 51, and 52 is/are rejected.
- 7) ☒ Claim(s) 50 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on February 10, 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 2/26/04, 3/3/05
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

This office action is in response to the information disclosure statement filed March 3, 2005. Claims 1-52 are pending.

Information Disclosure Statement

1. The prior art documents submitted by Applicant in the Information Disclosure Statements filed on February 26, 2004, and March 3, 2005, have been considered and made of record (note attached copy of forms PTO-1449).

Drawings

2. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because figures 23B and 23C are hand drawn and informal. Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Claim Objections

3. Claims 15-19 and 28-31 are objected to because of the following informalities: the term "waveguide grating coupler" was never used in the independent claim (1 and 19). "Grating coupler" was used for the claim language. Appropriate correction is required to either the independent claims 1 and 19, or these dependent claims.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 19, 21, 23, 27, 28, 32, 36-47, 51, and 52 are rejected under 35 U.S.C. 102(b) as being anticipated by Welch et al. U.S.P. No. 5,864,574.

Welch et al. U.S.P. No. 5,864,574 teaches (Fig. 9, column 9, line 65 through column 10, line 16) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 112 and a grating coupler 119, said coupler having at least a flared waveguide portion 114 comprising both a “relatively” narrow end and “relatively” wide end, the flared portion 114 having a grating positioned to couple light between said coupling waveguide and a further optical element; wherein the grating comprises curved elongate scattering elements which are substantially elliptical so as to couple waves between the grating and the optical elements, which clearly, fully meets Applicant’s *claimed* limitations.

Regarding claim 21, the numerical aperture of the flared portion (with a grating) is inherently smaller than the numerical aperture of the waveguide portion.

Regarding claim 23, a fiber can be coupled to the optical system (Figs. 19-20).

Regarding claim 27, the length of the sidewall substantially matches the width of the “relatively” wide end portion (see figures).

Regarding claim 28, the waveguide is at least a channel (see figures).

Regarding claim 32, the optical apparatus is disposed over a substrate.

Regarding claim 36, the structural limitations of the device of Welch et al. ‘574 make inherent the properties, since the same structural limitations are presented.

Regarding claims 37-40, the planar waveguiding region has sidewalls, and is a channel, while a flared portion exists, one end being narrow, the opposite being wide (see Fig. 9).

Regarding claim 41, the concave side faces the narrow portion of the waveguide.

Regarding claim 42, the curves are substantially elliptically shaped.

Regarding claims 43 and 44, a single mode fiber can be employed in the optical system (Figs. 19 and 20), which supports a single optical mode.

Regarding claim 45, the waveguide inherently *can* support a single polarization by its geometry.

Regarding claim 46, the cross section of the fiber can be substantially larger (see Fig. 19).

Regarding claim 47, for proper propagation, the numerical aperture of the waveguide can be substantially larger than the fiber.

Regarding claim 51, the system inherently acts in this manner since all of the structural limitations are met by the device of Welch et al. '574.

Regarding claim 52, the curvature is substantially circular path-like.

6. Claims 1-4, 6-9, 13, 15, 19-21, 23, 27, 28, 32, 36-45, 47, 51, and 52 are rejected under 35 U.S.C. 102(b) as being anticipated by O'Brien et al. U.S.P. No. 5,793,521.

O'Brien et al. U.S.P. No. 5,793,521 teaches (Figs. 5, 7, 12a, 30, 31; column 9, lines 19-36; column 11, lines 41-53; column 13, lines 16-36) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 160 and a grating coupler 161, the coupler having at least a flared waveguide portion comprising a narrow end and a wide end, the grating positioned to couple an optical signal between the coupler and an optical element,

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wherein the grating 161 comprises curved elongate scattering elements having curvatures defined by substantially elliptical paths in order to couple waves between the grating coupler and an optical element, which clearly, fully meets Applicant's *claimed* limitations (claim 19).

Regarding claim 1 (and dependent claim 20), in another embodiment (see Fig. 5), the flared portion is disclosed having curved sidewalls in a substantially hyperbolic path.

Regarding claims 2-4, the grating comprises curved elongate scattering elements that are both *substantially* elliptical and circular.

Regarding claims 6 and 23, an optical single mode fiber can be coupled thereto.

Regarding claim 7, the two curved sidewalls *can* support this particular propagation.

Regarding claims 8 and 21, the numerical aperture of the flared portion (with a grating) is inherently smaller than the numerical aperture of the waveguide portion.

Regarding claim 9, the spacing is inherently selected to attain the desired result.

Regarding claims 13 and 27, the length *substantially* matches the width in certain embodiments.

Regarding claims 15 and 28, the waveguide at least in formed in a channel.

Regarding claim 32, the optical apparatus is disposed over a substrate.

Regarding claim 36, the structural limitations of the device of O'Brien et al. '521 make inherent the properties, since the same structural limitations are presented.

Regarding claims 37-40, the planar waveguiding region has sidewalls, and is a channel, while a flared portion exists, one end being narrow, the opposite being wide (see Figs. 12a, 30, 31).

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Regarding claim 41, the concave side faces the narrow portion of the waveguide (Fig. 31).

Regarding claim 42, the curves are substantially elliptically shaped.

Regarding claims 43 and 44, a single mode fiber can be employed in the optical system, which supports a single optical mode.

Regarding claim 45, the waveguide inherently *can* support a single polarization by its geometry.

Regarding claim 47, for proper propagation, the numerical aperture of the waveguide *can* be substantially larger than the fiber.

Regarding claim 51, the system inherently acts in this manner since all of the structural limitations are met by the device of O'Brien et al. '521.

Regarding claim 52, the curvature is substantially circular path-like.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1-18, 20, 22, 24-26, 29-31, 33-35, 48 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Welch et al. U.S.P. No. 5,864,574, and further in view of O'Brien et al. U.S.P. No. 5,793,521.

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Welch et al. U.S.P. No. 5,864,574 teaches (Fig. 9, column 9, line 65 through column 10, line 16) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 112 and a grating coupler 119, said coupler having at least a flared waveguide portion 114 comprising both a “relatively” narrow end and “relatively” wide end, the flared portion 114 having a grating positioned to couple light between said coupling waveguide and a further optical element; wherein the grating comprises curved elongate scattering elements which are substantially elliptical so as to couple waves between the grating and the optical elements.

Welch et al. ‘574 does not explicitly teach that the flare portion has curved sidewalls having a hyperbolic path (and further dependent claim limitations)

O’Brien et al. U.S.P. No. 5,793,521 teaches (Figs. 7, 12a, 30, 31; column 9, lines 19-36; column 11, lines 41-53; column 13, lines 16-36) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 160 and a grating coupler 161, the coupler having at least a flared waveguide portion comprising a narrow end and a wide end, the grating positioned to couple an optical signal between the coupler and an optical element, wherein the grating 161 comprises curved elongate scattering elements having curvatures defined by substantially elliptical paths in order to couple waves between the grating coupler and an optical element. O’Brien also teaches (Fig. 5) that the flared portion can have curved sidewalls to define a substantially hyperbolic path.

Since Welch et al. ‘574 and O’Brien et al. ‘521 are both from the same field of endeavor, the purpose disclosed by O’Brien et al. ‘521 would have been recognized in the pertinent art of Welch et al. ‘574.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the flared portion of the tapering waveguide structure of O'Brien et al. '521 into the straight lined flared portion of Welch et al. '574 for the purpose of improving the optical coupling capabilities of the waveguide device, by allowing for certain optical wavefronts to be passed through the structure. A person having ordinary skill in the art at the time the invention was made would have recognized using curved sidewalls for this purpose, in order to improve coupling and decrease error for certain types of wavefronts, when coupled through an optical system such as the one of Welch et al. '574.

Regarding claims 2-4, the grating comprises curved elongate scattering elements that are both *substantially* elliptical and circular.

Regarding claims 5, 22, and 49, although not explicitly disclosed as being at least 50% efficient, a person having ordinary skill in the art at the time the invention was made would have recognized that optical efficiency was desired and necessary for the systems (of at least 50%). Official notice has been taken of the efficiency limitation.

Regarding claims 6, an optical single mode fiber can be coupled thereto.

Regarding claim 7, the two curved sidewalls *can* support this particular propagation.

Regarding claims 8, the numerical aperture of the flared portion (with a grating) is inherently smaller than the numerical aperture of the waveguide portion.

Regarding claim 9, the spacing is inherently selected to attain the desired result.

Regarding claims 10-12, 14, 24-26, although not explicitly disclosed as being specific ranges of widths/lengths, a person having ordinary skill in the art at the time the invention was made would have recognized that it was obvious to try certain workable ranges of the

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widths/lengths, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

In re Aller, 105 U.S.P.Q. 233.

Regarding claims 13, the length *substantially* matches the width in certain embodiments.

Regarding claims 15, the waveguide at least in formed in a channel.

Regarding claims 16 and 29 although not explicitly disclosed as being a strip loaded waveguide, a person having ordinary skill in the art at the time the invention was made would have recognized that using any well-known waveguiding medium in the art was an obvious modification, as no patentable limitation results from using a different (and well-known) coupling waveguide. Strip loaded waveguides are well known for optical coupling performance and ease of manufacture.

Regarding claims 17, 18, 30, 31, 33-35, and 48, although not explicitly disclosed as being silicon or silicon oxide, a person having ordinary skill in the art at the time the invention was made would have recognized that using any well-known semiconductor materials for the grating, such as silicon or silicon oxide or silicon wafers or layered materials, would have been obvious for the purpose of improving optical coupling performance. Official notice has been taken for using silicon or silicon oxide for the semiconductor material.

9. Claims 5, 10-12, 14, 16-18, 22, 24-26, 29-31, 33-35, 46, 48, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Brien et al. U.S.P. No. 5,793,521.

O'Brien et al. U.S.P. No. 5,793,521 teaches (Figs. 5, 7, 12a, 30, 31; column 9, lines 19-36; column 11, lines 41-53; column 13, lines 16-36) an integrated optical apparatus comprising:

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a planar waveguide having an elongate guiding portion 160 and a grating coupler 161, the coupler having at least a flared waveguide portion comprising a narrow end and a wide end, the grating positioned to couple an optical signal between the coupler and an optical element, wherein the grating 161 comprises curved elongate scattering elements having curvatures defined by substantially elliptical paths in order to couple waves between the grating coupler and an optical element.

Regarding claims 5, 22, and 49, although not explicitly disclosed as being at least 50% efficient, a person having ordinary skill in the art at the time the invention was made would have recognized that optical efficiency was desired and necessary for the systems (of at least 50%). Official notice has been taken of the efficiency limitation.

Regarding claims 10-12, 14, 24-26, although not explicitly disclosed as being specific ranges of widths/lengths, a person having ordinary skill in the art at the time the invention was made would have recognized that it was obvious to try certain workable ranges of the widths/lengths, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 U.S.P.Q. 233.

Regarding claims 16 and 29 although not explicitly disclosed as being a strip loaded waveguide, a person having ordinary skill in the art at the time the invention was made would have recognized that using any well-known waveguiding medium in the art was an obvious modification, as no patentable limitation results from using a different (and well-known) coupling waveguide. Strip loaded waveguides are well known for optical coupling performance and ease of manufacture.

Regarding claims 17, 18, 30, 31, 33-35, and 48, although not explicitly disclosed as being silicon or silicon oxide, a person having ordinary skill in the art at the time the invention was made would have recognized that using any well-known semiconductor materials for the grating, such as silicon or silicon oxide or silicon wafers or layered materials, would have been obvious for the purpose of improving optical coupling performance. Official notice has been taken for using silicon or silicon oxide for the semiconductor material.

Regarding claim 46, it is well-known (at the time the invention was made) to a person having ordinary skill in the art to use optical fibers that have cross-sections being larger than the optical waveguide, for the purpose of having “wobble room” when aligning and coupling optical fibers to optical waveguide media.

Allowable Subject Matter

10. Claim 50 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The relevant prior art of record does not teach or reasonably suggest coupling an optical fiber having a transverse dimension that is at *least twenty times* as large as the width of the waveguide and *also twenty times larger* than the length of the grating coupler.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure, with respect to the state of the art of optical gratings having circular/elliptical shapes in waveguide regions: PTO-892 form references C-H.


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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel J. Petkovsek whose telephone number is (571) 272-2355.

The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272-2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Daniel Petkovsek
November 16, 2005


AKM ENAYET ULLAH
PRIMARY EXAMINER